doi:10.1017/hgl.2019.26
Hegel Bulletin, 41/1, 118–124

Thomas Posch (1974–2019)

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It was with great sadness that we learned in April 2019 of the death of the philosopher and scientist Thomas Posch at the age of 45. He had been severely ill for over two years. Posch achieved the rare distinction of completing two doctoral theses—one in philosophy (2002) and one in astrophysics (2004)—and he went on to make significant contributions in both fields. From 2003 until his death he was a lecturer in astronomy, the history of science and philosophy at the University of Vienna, and in 2006 he was appointed as staff scientist at the University's Institute for Astronomy (later Astrophysics). His main topic of research at the Institute was astromineralogy, but he was also an active campaigner against light pollution. Indeed, he co-edited one of the most influential German-language books on the subject (Posch *et al.,* 2013), and in 2014 he received the Galileo Award for his work in this area from the International Dark Sky Association.

Posch believed strongly that scientific research should, where possible, be carried out in dialogue with other disciplines, especially theology, philosophy and the humanities, and he had a particular interest in Hegel's philosophy of nature, on which he undertook important research alongside his scientific study of the heavens. He wrote what is to my mind one of the most intelligent and accessible essays on Hegel's philosophy of nature (Posch 2011), in which he eloquently defends Hegel's critique of reductionism in science (see also Posch 2005b). He co-edited two invaluable editions of Hegel's lectures on the philosophy of nature —1821/22 (Hegel 2002) and 1825/26 (Hegel 2007)—and two fine volumes of essays on, respectively, Hegel's philosophy of nature (Wahsner und Posch 2002) and Hegel and the sciences (Posch und Marmasse 2005). He wrote notable essays on the reception of Hegel's philosophy of nature by critics such as William Whewell and Karl Popper (Posch 2001a and 2002); and in 2004 he gave an important paper at the annual conference of the Hegel Society of Great Britain on Hegel's critique of Newton, in which he points out that, for Hegel, there is more abstract metaphysics in Newton's concept of force than is usually recognised (see Posch 2004, which, however, is a draft that unfortunately has not been edited into a publishable form).

Posch also wrote two monographs that are of enormous value to those interested in Hegel's philosophy of nature and, indeed, the history of science more generally. Since these books may not be familiar to all readers of *Hegel*

Bulletin, I would like to take this opportunity to explain briefly what they are about and what makes them important.

Posch's first doctoral dissertation was published as Posch (2005a). This work is, in my view, one of the best studies of Hegel's philosophy of nature there is. Indeed, it provides a model for how one should approach what is probably the most neglected part of Hegel's philosophy: it examines Hegel's ideas in detail and makes good sense of them (whilst also recognising their occasional obscurity), and it sets them, with subtlety and intelligence, in relation to both the science of Hegel's time and later developments in science. Posch recognizes that the topic of his book—Hegel's theory of heat—is largely ignored even by the relatively few people who study Hegel's philosophy of nature at all. This is due partly to the considerable conceptual difficulty of Hegel's account of physics and chemistry (in contrast to his mechanics and organics), but also to the fact that the sciences underpinning that account—the theories of heat and electromagnetism, as well as anorganic chemistry—were still in their infancy at the start of the nineteenth century (Posch 2005a: 2–4). In Posch's view, however, it is precisely these difficulties, as well as Hegel's significant and enduring insights, that make it important to study and explain his account of heat. Posch focuses on Hegel's Jena philosophy of nature of 1805–06 because it contains his most extensive text on the topic of heat. Towards the end of his book, however, Posch highlights the continuities and differences between Hegel's Jena theory of heat and the theories contained in the Heidelberg and Berlin editions of the *Encyclopaedia* (Posch 2005a: 149ff.).

Before turning to Hegel directly Posch provides an invaluable survey of the philosophical and scientific theories of heat advanced by Aristotle, Francis Bacon, Robert Boyle, Joseph Black, Antoine Lavoisier and others, and he notes that around 1800 the central problem concerning heat was this: is heat a substance—'caloricum' (Posch 2005a: 34)—or rather a *kinetic* phenomenon, that is, the movement or 'vibrating' of the parts of bodies? Later in the nineteenth century the kinetic theory prevailed and became part of modern thermodynamics; around 1800, however, the conflict between the conceptions of heat as substance and as movement had not yet been resolved. Posch points out that in the 1827 and 1830 editions of his *Encyclopaedia*, Hegel is severely critical of the substance theory of heat and draws a parallel between heat and sound, both of which he conceives as forms of the 'negation' of the cohesion of bodies. For the later Hegel, heat is thus not a substance but an *activity* that manifests itself in the expansion of bodies (Posch 2005a: 154). In his Jena philosophy of nature of 1805–6 Hegel does not yet criticize explicitly the substance theory of heat, but there too he conceives of heat as 'negativity' or, more specifically, as the 'power of dissolving shape', evident for example in the process of melting. As Posch puts it, Hegel interprets heat as an immanent (as opposed to an external) negation of a body that frees it to take on a 'higher mode of material organisation' (Posch 2005a: 61–62, 120).

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Hegel's 'intuition of genius' in his Jena manuscript, however, lies in recognizing an intimate connection between heat and the expansion of *gases* at a time when the theory of heat and the theory of gases were by no means universally understood to be connected. More specifically, Hegel takes over from Gay-Lussac the idea that all gases, when heated, 'expand to the same extent'—an idea that was not beyond dispute at the time—and gives it a conceptual underpinning (Posch 2005a: 135). As Posch explains, Hegel points out that solid bodies have different 'coefficients of expansion' and in that respect can be understood to determine themselves in distinctive ways. Gases, by contrast, all expand in the same way when heated and in that respect *lack individual self-determination*. Hegel thus makes philosophical sense of an observed (though not undisputed) phenomenon by giving gases a place in the development of nature from the sheer self-externality of space to the explicit self-determination of the organism. In the process he also provides a philosophical foundation for the connection between heat and the expansion of gas that would later become widely accepted by science.

By examining Hegel's theory of heat Posch shows that Hegel has a subtle understanding of natural phenomena and the science of his time and is not the ignorant and arrogant philosopher of nature that critics, such as Whewell and Matthias Schleiden, took him to be (Posch 2005a: 178–79). Anyone who still doubts whether there is much to be learned from Hegel's philosophy of nature will have their doubts allayed by Posch's subtle, intelligent, indeed exemplary, book.

Students of Hegel's philosophy of nature will also find much to interest them in Posch's outstanding biography of the astronomer Johannes Kepler (Posch 2017). Hegel considered Kepler (1571–1630) to be a scientist of unparalleled genius and regarded his three laws of planetary motion as 'a discovery of immortal fame' (*EN*: §270R/66). Kepler's genius, for Hegel, lay in his ability to find 'universal law' in the empirical observations of Tycho Brahe; and his laws—especially the third—are so important because, though found 'by induction', they disclose the rationality inherent in nature itself, or what Hegel calls the '*reason of the thing*' (*Vernunft der Sache*) (*EN*: §270R and A/71–72; see also §280R/103). Hegel does not deny Newton's ground-breaking contribution to the mathematical analysis of celestial motion, and he acknowledges the importance of Newton's discovery of the way in which planets—in particular Jupiter and Saturn —'perturb' one another. In Hegel's view, however, Kepler deserves the highest praise for first discovering the basic laws that govern planetary motion, and Hegel notes that 'seldom has fame been more unjustly transferred from a first discoverer to another person' (in this case, Newton) (*EN*: §270R/66–68; see also Posch 2017: 230–32).

Posch explains in detail how Kepler discovered his three laws by applying his own 'mathematical genius' to Brahe's 'precise observations' of the planets. Posch shows, for example, how specific and easily missed features of the orbit of Mars led Kepler to formulate his first law that planets orbit the sun in an ellipse rather than a

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circle (Posch 2017: 92–94). Posch also notes that Kepler made significant contributions to optics and crystallography, that he was the first to argue that the sun rotates on its axis, and that he predicted the transits of Mercury and Venus across the sun which would occur in 1631 (after his death) (Posch 2017: 76–77, 118, 154, 197–201). Furthermore, Posch sets out in subtle detail the historical and religious context in which Kepler undertook his astronomical work, and he highlights with a touching empathy the personal difficulties that Kepler faced throughout his life (including, for example, the fact that his mother was accused of witchcraft) (see, e.g., Posch 2017: 170–74).

Posch writes as a professional astronomer and historian of science, but he endorses Hegel's evaluation of the enduring significance of Kepler's work. In particular, he agrees with Hegel that Kepler's third law—which states that the squares of the orbital periods of any two planets are proportional to the cubes of their mean distance from the sun (or, more precisely, of their semi-major axes)—is one of the 'great laws of nature' (Posch 2017: 224; see also Houlgate 2005: 147–53, 156). Posch also agrees with Hegel that Kepler sought not just to develop a mathematical interpretation of phenomena or to construct a coherent 'model' of nature, but to disclose the reason that is inherent in nature itself. As Posch writes, 'there are in nature objective spiritual [*geistig*] structures, to which the laws of nature belong, which are thus not just human constructs. Kepler, Hegel and Einstein were profoundly convinced of this' (Posch 2017: 231). Posch argues that Kepler sought to understand the rationality in nature because he saw nature as the harmonious work of God (Posch 2017: 53, 167). His aim, therefore, was not only to increase our scientific knowledge of the cosmos, but also to integrate such knowledge into a metaphysical, religious and indeed aesthetic view of the cosmos—one in which 'the laws of nature include harmonic relations between numbers that we know from music' (Posch 2017: 223; see also *EN*: §280R/103). For Posch, therefore, it was not just 'Swabian regional patriotism' (Posch 2017: 16)—the fact that all three studied at the University of Tübingen—that led Hegel and Schelling to praise Kepler, but a deep appreciation of the fact that Kepler's thinking combined science and rational metaphysics in a way that has become so unfashionable in modernity.

Posch clearly favours Kepler's more holistic and metaphysical conception of nature over what he calls the 'mechanistic world-view' of modern science (Posch 2017: 226). He insists that, for Kepler, it is essential in astronomy to achieve exact measurements and 'precise numbers'. He claims, however, that modern science often espouses a 'barren naturalism' that would banish all metaphysical, religious or aesthetic concerns from the study of nature (Posch 2017: 234, 238). By contrast, 'Kepler's cosmos is one in which reason and even aesthetic ideals of humanity find an intensive echo. Kepler's cosmos is not only accessible to sober geometrical measurement …. It is a cosmos whose spiritual [*geistig*] structure

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allows humanity to find itself in it again with amazement and great joy' (Posch 2017: 238).

In my view, Posch's biography of Kepler is a magnificent achievement. It explains with impressive clarity and eloquence Kepler's ground-breaking discoveries in astronomy; it sheds light on the religious and political conditions in central Europe in the late sixteenth and early seventeenth centuries; and it raises important and enduring questions about the relation between science, religion and metaphysics. It is also immensely valuable for those interested in Hegel's philosophy of nature, for Kepler's influence on Hegel's understanding of celestial mechanics is unparalleled. I hope that in the not too distant future Posch's wonderful book will be translated into English so that more students of Hegel worldwide can learn from it.

Posch notes that at one point Kepler taught Latin literature, ethics and history, as well as mathematics, and that he wrote thirty-six poems in the course of his life (Posch 2017: 48, 53). Kepler also showed his 'artistic vein' in the elegance of his scientific writing and correspondence (Posch 2017: 239). It is thus understandable that he became an important figure not just for later astronomers and philosophers but also for later poets, such as Hölderlin and Novalis (Posch 2017: 227–28).

Posch emulated his illustrious predecessor by also engaging in literary activity alongside his research in astronomy, and in 2001 he published a volume of poems and short prose texts entitled *Miniaturen* (Posch 2001b). Posch's sharply observed prose 'miniatures' often focus on *individuals*—the monk, the singer, the author—but in so doing (and in a way that should resonate with readers of Hegel) they highlight themes of *universal* human interest. These pieces are sometimes amusing or quirky, sometimes touching and even sad, but they are always original and thought-provoking. They show empathy for the individuals concerned, but without sentimentality, and when they remind us of our responsibilities to others (human and non-human), they do so without any hint of moralising. They are the work of a man who took his own responsibilities seriously—especially in trying to combat light pollution—and who, in so doing, was sometimes melancholy, often witty and humorous, and always perceptive, thoughtful and, above all, generous.

It was a privilege and pleasure to know Thomas Posch, and his passing at such a young age is a cause for deep sadness. His work will, however, remain a rich source of understanding and inspiration for years to come.

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https://doi.org/10.1017/hgl.2019.26 Published online by Cambridge University Press

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https://doi.org/10.1017/hgl.2019.26 Published online by Cambridge University Press